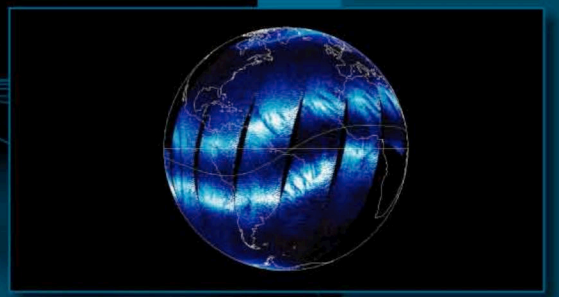
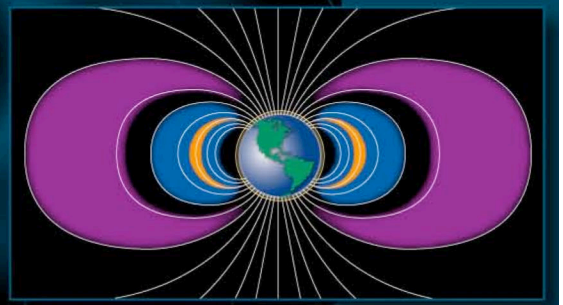
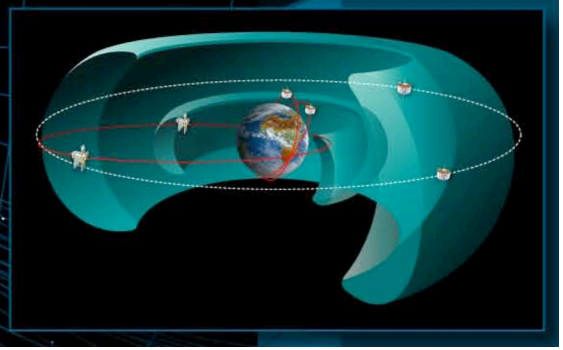
Living with a Star







Announcement of Opportunity for the Radiation Belt Storm Probes

and Geospace-Related Missions of Opportunity

Lika Guhathakurta

LWS Program Scientist

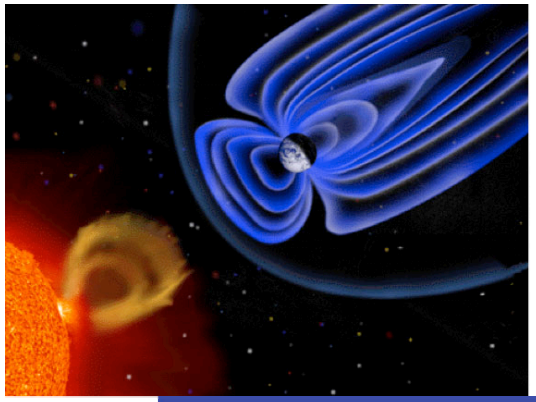
Living With a Star Program Goal

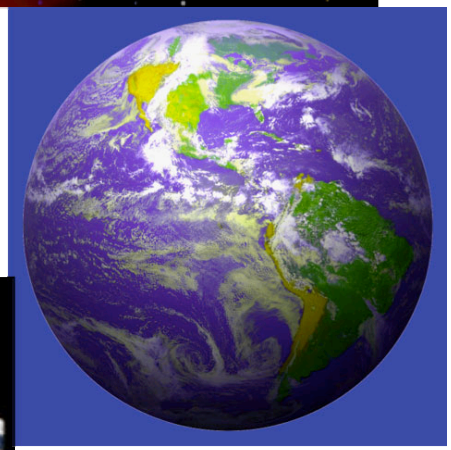
Living with a Star Program Goal: Develop the scientific understanding necessary to effectively address those aspects of the connected Sun Earth system that directly affect life and society.

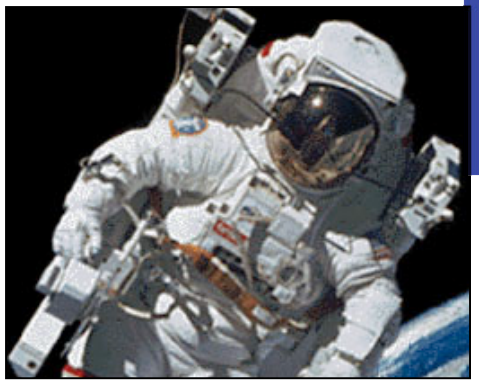
Why Do We Care?

- **Solar Variability Affects Human Technology, Humans in Space, and Terrestrial Climate.**

- **The Sphere of the Human Environment Continues to Expand Above and Beyond Our Planet.**
  - Increasing dependence on space-based systems
  - Permanent presence of humans in Earth orbit and beyond







GLOBAL SOCIETAL CONSEQUENCES OF SOLAR VARIABILITY

Human Radiation Exposure

- Space Station
- Space Exploration and Utilization
- High Altitude Flight

Impacts on Technology

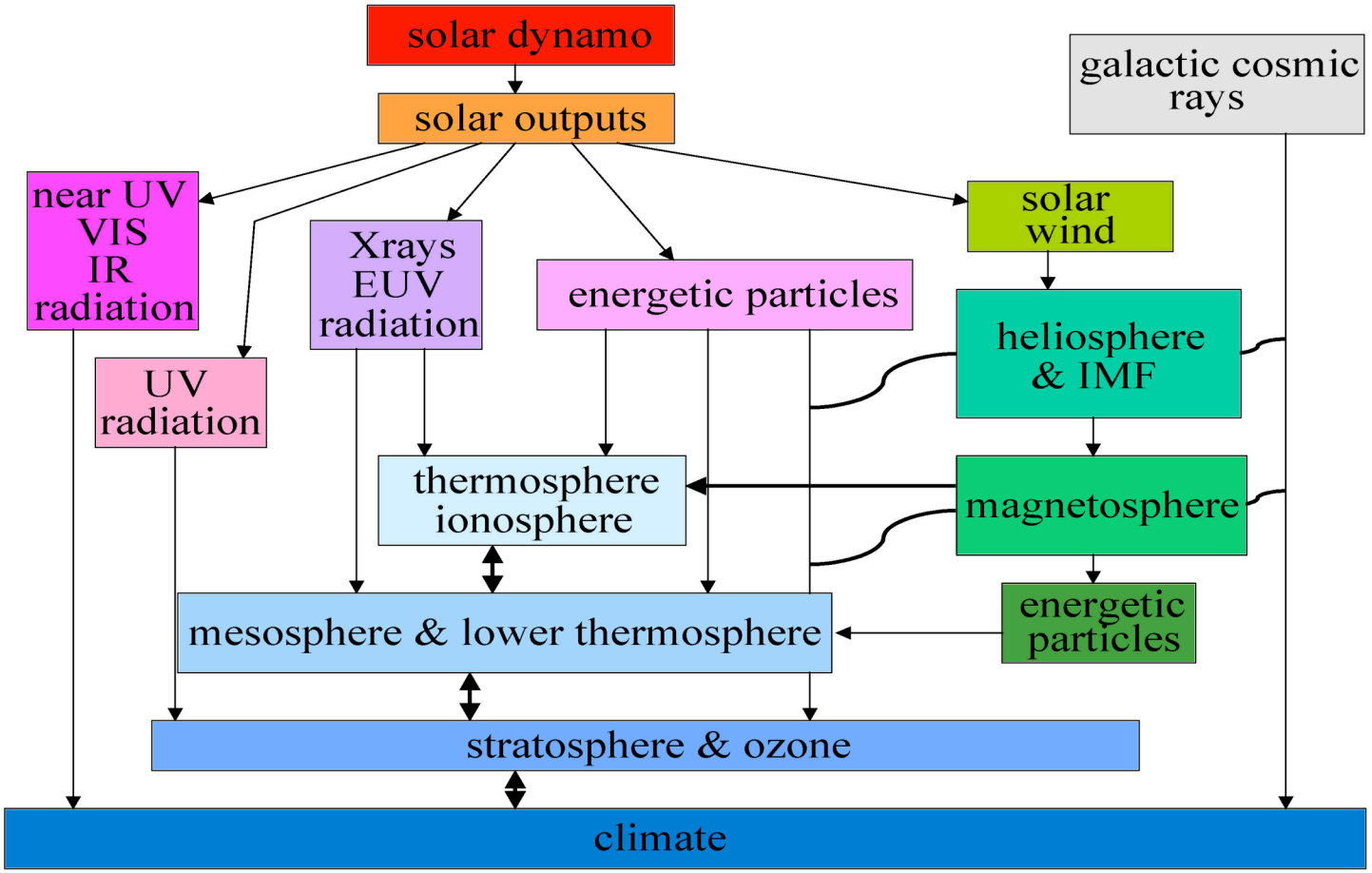
- Space Systems
- Communications, Navigation
- Terrestrial Systems

Terrestrial Climate

- Short Term
- Long Term

LWS is a Systems Approach

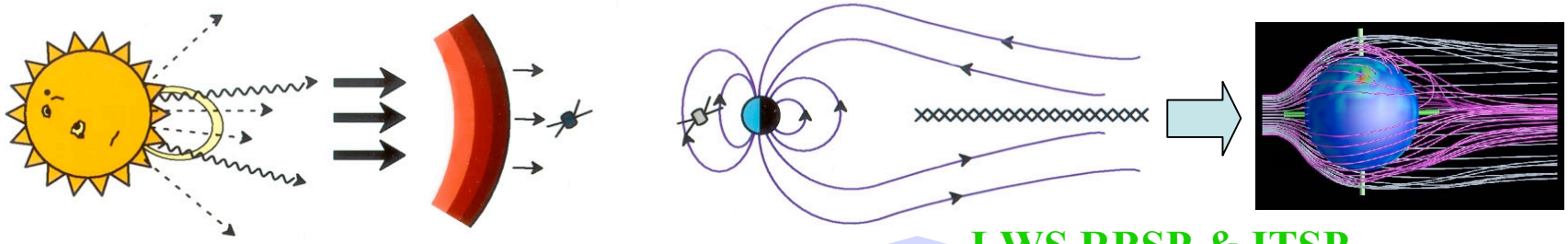
LWS focuses not on any one region of space, but rather on our Sun Earth Region as one system



A very important part is the study of the connection between the regions and how one drives a response in another.

Prediction Requires Understanding. Understanding Requires a System-Wide Approach

How do we link what happens at the Sun with the planetary response?



STEREO, **SDO**, **Solar Probe**

ACE, STEREO, **Solar Sentinels**

LWS RBSP & ITSP

Measure at Earth

Model at Planets

Observing the Source
Active Regions
X-ray, EUV, UV
Energetic Particles
Solar Wind

Characterizing Propagation
Solar Energetic Particles
Coronal Mass Injections
I. P. Shocks

Understanding Planetary responses
Ionosphere-Upper Atmosphere
Radiation Processes
Space / Atmosphere Interactions

Scope of the LWS Program

The first phase of the LWS strategic program elements are:

- Solar Dynamics Observatory (SDO)
- The Geospace Missions Network
- Solar Sentinels
- Space Environment Testbeds
- Targeted Research and Technology

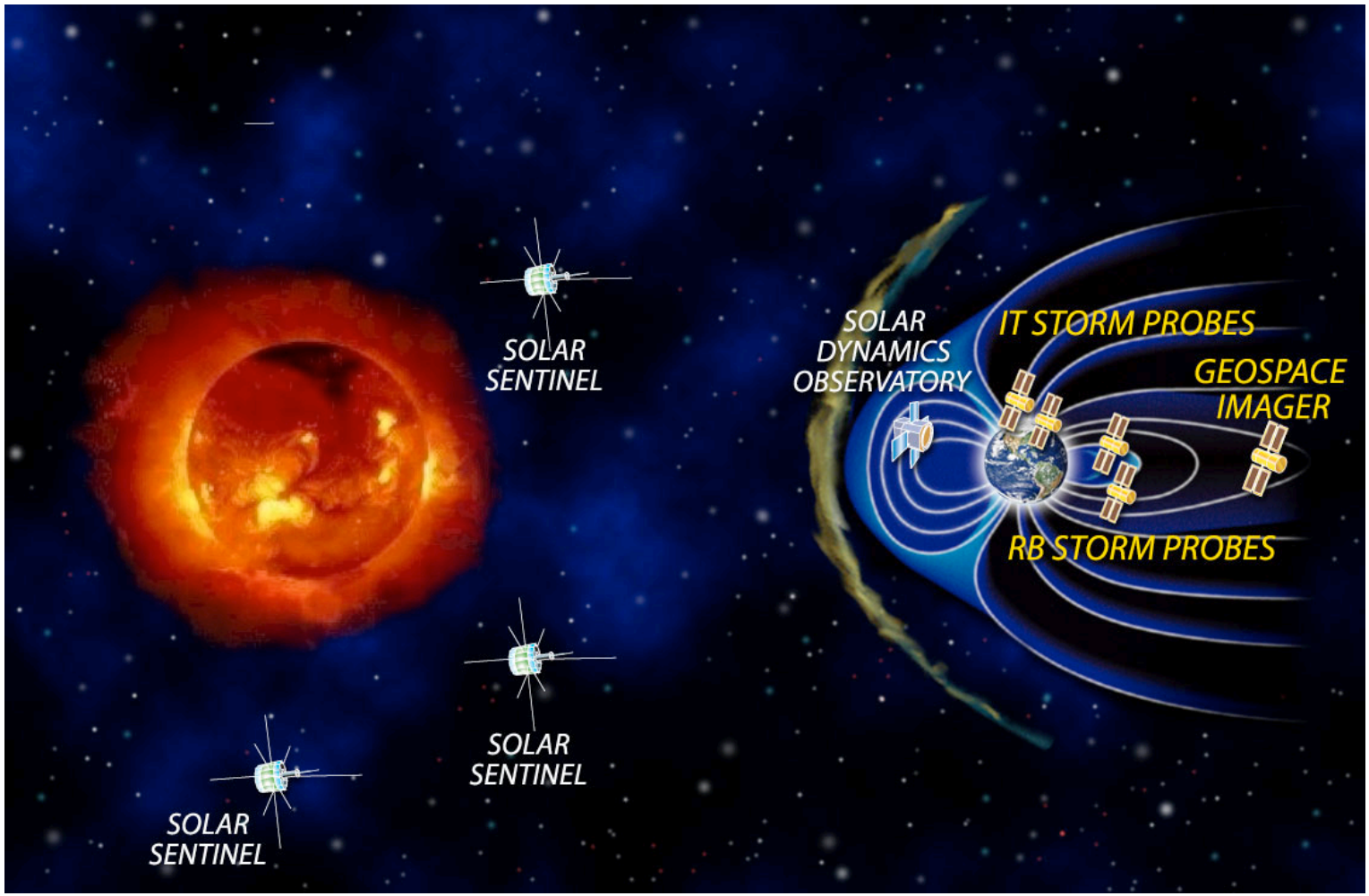
Objectives of the LWS Geospace

Understand those geospace phenomena that have the largest impact on society. GMDT analysis indicated that these occur in the radiation belts, the thermosphere/ionosphere and the polar cap.

Understanding *and* characterization is important for developing the needed physics-based and empirical space environment models and for diagnosing and predicting the wide variety of space weather effects:

- global climate change
- satellite anomalies
- satellite drag
- communication/navigation/radar disruptions
- human exposure to radiation

The Radiation Belt Storm Probes:
Role within the Living With a Star Program



Radiation Belt Storm Probes – twin spacecraft in highly elliptical orbits to understand the basic principals behind relativistic particle acceleration, transport, and loss.